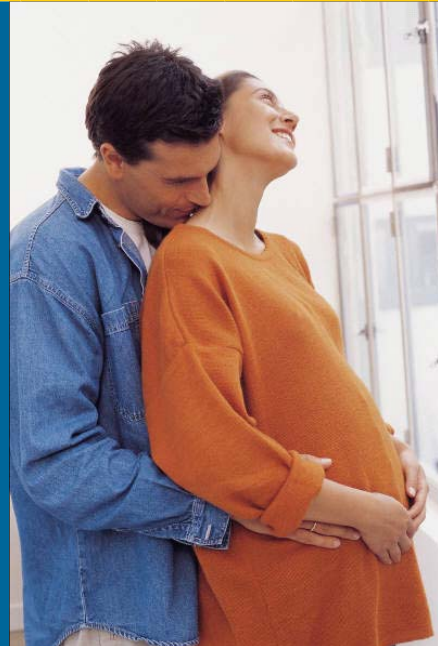
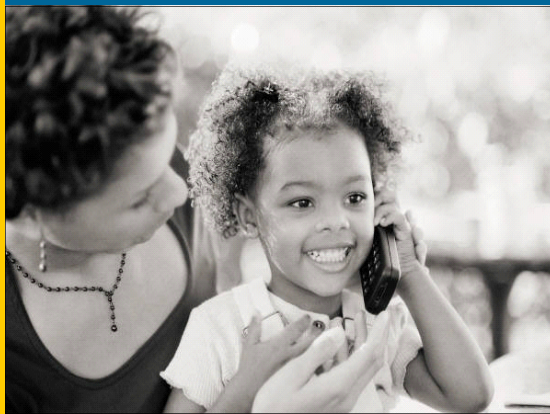


ABRIDGED



PERINATAL PERIODS OF RISK



A Community Approach
to Address Fetal and Infant
Mortality in Maricopa County

*Maricopa County
Department of Public Health*



Perinatal Periods of Risk: A Community Approach to Address Fetal and Infant Mortality In Maricopa County

Abridged Version

PRODUCED BY
MARICOPA COUNTY DEPARTMENT OF PUBLIC HEALTH

DIVISIONS OF
EPIDEMIOLOGY & DATA SERVICES
&
MATERNAL, CHILD & FAMILY HEALTH

JULY 2004

For expanded and abridged versions of this document, go to:
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Table of Contents

SECTION I. EXECUTIVE SUMMARY.....	4
<i>Maricopa County</i>	<i>5</i>
<i>Maryvale</i>	<i>7</i>
<i>South Phoenix</i>	<i>8</i>
SECTION II. PERINATAL PERIODS OF RISK OVERVIEW	10
SECTION III. PPOR: MARICOPA COUNTY RESULTS.....	15
PHASE I: FETO-INFANT MORTALITY.....	15
<i>Excess (Preventable) Feto-Infant Mortality.....</i>	<i>16</i>
<i>Excess Feto-Infant Mortality for Selected Population Groups</i>	<i>17</i>
SUMMARY OF PHASE II RESULTS.....	20
<i>Maternal Health and Prematurity.....</i>	<i>20</i>
<i>Maternal Care.....</i>	<i>21</i>
<i>Newborn Care.....</i>	<i>22</i>
<i>Infant Health</i>	<i>22</i>
SECTION IV. PPOR: MARYVALE NEIGHBORHOOD	24
PHASE I: FETO-INFANT MORTALITY.....	24
<i>Excess (Preventable) Feto-Infant Mortality.....</i>	<i>24</i>
<i>Excess Feto-Infant Mortality for Selected Population Groups</i>	<i>26</i>
SUMMARY OF PHASE II RESULTS.....	28
<i>Maternal Health and Prematurity.....</i>	<i>28</i>
<i>Maternal Care.....</i>	<i>29</i>
<i>Newborn Care.....</i>	<i>30</i>
<i>Infant Health</i>	<i>30</i>
SECTION V. PPOR: SOUTH PHOENIX NEIGHBORHOOD.....	31
PHASE I: FETO-INFANT MORTALITY.....	31
<i>Excess (Preventable) Feto-Infant Mortality.....</i>	<i>32</i>
<i>Excess Feto-Infant Mortality for Selected Population Groups</i>	<i>33</i>
SUMMARY OF PHASE II RESULTS.....	35
<i>Maternal Health and Prematurity.....</i>	<i>35</i>
<i>Maternal Care.....</i>	<i>36</i>
<i>Newborn Care.....</i>	<i>37</i>
<i>Infant Health</i>	<i>37</i>
SECTION VI. COMMUNITY MOBILIZATION	39
MARYVALE	39
SOUTH PHOENIX.....	40
FUTURE EFFORTS	41

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Perinatal Periods of Risk: A Community Approach to Address Fetal and Infant Mortality in Maricopa County, Abridged Version. Maricopa County Department of Public Health. Phoenix, AZ. 2004.

Acknowledgements

This report was prepared by the Maricopa County Department of Public Health, *Division of Epidemiology and Data Services (EPI)*, in collaboration with the *Division of Maternal, Child and Family Health (MCFH)*.

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MCDPH would like to thank the following for support of this project:

- The Virginia G. Piper Charitable Trust provided partial funding.
- The PPOR Practice Collaborative provided information to conduct the PPOR project. CityMatCH and the CDC, in partnership with the National March of Dimes and the Health Resources and Services Administration (HRSA), initiated the collaborative.
- The Arizona Department of Health Services, Office of Women and Children's Health provided the funding for the County Prenatal Block Grant covering maternal and child health services and printing of this document.
- The Healthy Mothers, Healthy Babies Coalition, Maryvale community organizers, and South Phoenix Healthy Start collaborated on the project.
- Kevin Vossen designed the cover.

MCDPH would like to express appreciation to the individuals who comprise the Maternal and Child Health Advisory Group:

Deborah Donofrio, Head Start Health Coordinator; Lisa Derrick, Healthy Start Director; Sylvia Echave Stock, Mountain Park Health Center CEO; Barbara Freeman-Maney, Phoenix Birthing Project CEO; Barb Jorgensen, Southwest Human Development Health Services Manager; Aimee Laughery, Clinica Adelante Health Start Program Coordinator; Cyndi Tercero, Dropout Prevention Program Developer, Phoenix Union High School District; Terri Leija, Executive Assistant to Maricopa County Supervisor Mary Rose Wilcox; Rachel Whyte, DES Healthy Families Statewide Coordinator.

Section I. Executive Summary

The Perinatal Periods of Risk approach to fetal and infant mortality (PPOR) is a method to analyze standard vital registration records (births, infant deaths, and fetal deaths) that is based on a prevention framework. The goal is to prioritize and target prevention and intervention efforts in those areas where they may be most effective. Based on birth weight and age of death, the PPOR approach partitions fetal and infant deaths into four areas that correspond to specific intervention points in the health care continuum. These four components have different causes of death, risk factors, and corresponding interventions.

- The “maternal health and prematurity” category corresponds to the mother’s health prior to and between pregnancies, health behaviors, and perinatal care.
- The “maternal care” category corresponds to prenatal care, high risk obstetric care, and the referral system.
- The “newborn care” category corresponds to perinatal management, perinatal systems, and pediatric surgery.
- The “infant health” category consists of many environmental factors such as sleep position, breast-feeding, injury prevention, and the prevention of infectious diseases.

The approach additionally provides an estimate of the amount of fetal and infant mortality that is preventable (excess mortality), by comparing the feto-infant mortality rates in select population groups to a reference group that has low mortality rates. The identification of risk factors are then based on the population groups and categories with high excess mortality.

The data consist of births, fetal deaths, and infant deaths in Maricopa County during the period 1996 through 2000. The communities of analysis are Maricopa County, the South Phoenix area, and the Maryvale area. This document will describe an overview of both Phases of PPOR: the first phase of partitioning the deaths into the categories described above and the second phase of data analyses that attempts to ascertain potential reasons for the excess mortality in the categories with the highest excess rates. Additionally, a brief history of the corresponding community activities will be included.

A second component of the PPOR approach consists of community mobilization. Community support and input are integral to the PPOR process. The community is the motivating force for initiating change and sustaining these efforts. Community partners and maternal and child health care stakeholders are identified and engaged at the beginning of the PPOR process for collaboration and to facilitate a sustained effort to reduce mortality. See Section VI on page 37.

A more detailed description of the results, methodology, causes of death, glossary of terms, references, and acronyms are located in the full PPOR report at www.maricopa.gov/public_health/epi.

Key Findings

Maricopa County

Phase I

- The total feto-infant mortality rate (F-IMR) from 1996 through 2000 was 8.5 deaths (per 1,000 live births and fetal deaths).
- The excess F-IMR during the period was 2.7 deaths (per 1,000 live births and fetal deaths), suggesting that **32% of the fetal and infant deaths were potentially preventable.**
- The highest excess group-specific rate was “maternal care,” while the second highest rate was “maternal health/prematurity.”
- **The excess F-IMR for women under the age of 20 (5.9) was more than twice the excess rate for those women who were 20 or more years of age (2.2 deaths per 1,000 live births and fetal deaths),** although the absolute numbers of births and deaths were smaller.
 - For women less than 20 years old, the highest rate was “maternal health/prematurity” followed by “infant health.”
 - For women 20 or more years of age, the highest rate was “maternal care.”
- **Education, a risk factor amenable to modification, showed the largest impact on feto-infant mortality rates consistently across all areas (even above age and race/ethnicity). The excess F-IMR for women with a high school education or less (7.1) was 18 times higher than the excess F-IMR for women with some education beyond high school (0.38 deaths per 1,000 live births and fetal deaths).** The highest rate for those women with less education was in the “maternal care” category.
- **Non-Hispanic African Americans had the highest excess F-IMR (8.2) of all race/ethnic groups,** followed by Non-Hispanic Native Americans (4.3), Hispanics (3.5), and Non-Hispanic Whites (1.9).
- **Each race/ethnicity showed a different pattern across the excess feto-infant mortality map suggesting that programs might consider targeting these groups differently.**
 - African American’s highest rate was in the “maternal health/prematurity” category, followed by the “infant health” category.
 - Native American’s highest rate was in the “infant health” category, followed by the “maternal care” category.
 - For Hispanics, the “maternal health/prematurity” and “maternal care” categories were equally high ¹.
 - White’s highest rate was in the “maternal health/prematurity” category, followed by the “maternal care” category.

Phase II

Risk factors predicting negative pregnancy outcomes were identified through logistic regression analysis for all Maricopa County births and fetal deaths. These risk factors were used in all smaller area analyses (i.e., Maryvale and South Phoenix). The two tables that follow identify these general factors and the specific populations targeted for interventions in Maricopa County.

¹ For the remainder of this report, the term “African American” refers to non-Hispanic African Americans; “Native American” refers to non-Hispanic Native Americans; “White” refers to non-Hispanic Whites.

MARICOPA COUNTY: RISK FACTORS PREDICTING NEGATIVE PREGNANCY OUTCOMES

Negative Pregnancy Outcomes			
Maternal Health and Prematurity		Maternal Care	Infant Health
Very Low Birth Weight Birth	Very Low Birth Weight Fetal or Infant Death	Higher Birth Weight Fetal Death	Higher Birth Weight Post-Neonatal Death (28 days to 1 Year of Age)
	Mother's education is a high school degree or less	Mother's education is a high school degree or less	Mother's education is a high school degree or less
Mother African American			Mother African American or Native American
Mother a teenager			Mother a teenager
Too few prenatal care visits	Too few prenatal care visits	Inadequate prenatal care	Too few prenatal care visits
Smoking during pregnancy			Smoking during pregnancy
Less than 15 lbs. weight gain during pregnancy			
Lack of social support and SES advantages (unmarried mother)			
Previous preterm baby; Premature or small-for-gestational-age baby		Premature or small-for-gestational-age baby	
Multiple birth			
	Service level of delivery hospital		
	Congenital anomalies		
	Fever during labor		
	Precipitous labor		
	Newborn assisted ventilation		
	Cord prolapse		
		Maternal Diabetes	
		Placenta previa/abruption	
		Breech/malpresentation	
		Cord prolapse	

Note. The risk factors are not listed in order of importance. Very low birth weight is less than 1500 grams (3.3 lbs.) and higher birth weight is 1500 grams or more.

**MARICOPA COUNTY: POPULATION GROUPS WITH SIGNIFICANT
RISK FACTORS TO BE TARGETED FOR INTERVENTIONS.**

	Negative Pregnancy Outcomes			
	Maternal Health and Prematurity		Maternal Care	Infant Health
Populations	Very Low Birth Weight Birth	Very Low Birth Weight Fetal or Infant Death	Higher Birth Weight Fetal Death	Higher Birth Weight Post-Neonatal Death (28 days to 1 Year of Age)
Teenage Mothers	Too few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.			Too few prenatal care visits.
Mothers with a High School Degree or Less Education	Too few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby. Smoking.	Too few prenatal care visits. Service level of delivery hospital. Fever during labor and delivery. Newborn assisted ventilation.	Inadequate prenatal care. Premature or small-for-gestational-age baby.	
African American Mothers	Too few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby. Smoking.			Too few prenatal care visits. Smoking
Native American Mothers			Inadequate prenatal care. Premature or small-for-gestational-age baby. Maternal diabetes.	Too few prenatal care visits.

Note. The risk factors are not listed in order of importance. Very low birth weight is less than 1500 grams (3.3 lbs.) and higher birth weight is 1500 grams or more.

Maryvale

Phase I

- The total feto-infant mortality rate from 1996 through 2000 was similar to the county's rate, 8.8 deaths per 1,000 live births and fetal deaths.
- The excess feto-infant mortality rate during the period was 3.0 deaths (per 1,000 live births and fetal deaths), suggesting **that 34% of the fetal and infant deaths were potentially preventable.**
- The highest excess group-specific rate was "maternal health/prematurity," while the second highest rate was "maternal care."
- Unlike the Maricopa County findings, the excess death rate and pattern of results did not vary by age group (women under the age of 20 versus women 20 years of age and older).
- **The excess F-IMR for women with a high school education or less was 4.6,** while there was essentially no excess for women with some education beyond high school. For the lower

education group, the highest group-specific rate was in the “maternal health/prematurity” category.

- **Although the overall excess F-IMR was almost identical for Hispanic (2.9) and non-Hispanic White (2.8) women, the pattern of mortality differed.** Hispanic women’s highest rate was “maternal health/prematurity” and non-Hispanic White women’s highest rate was “maternal care.”

Phase II

The following table identifies risk factors for the targeted population in Maryvale in accordance with the countywide predictive risk factors and the Phase I findings in Maryvale.

MARYVALE NEIGHBORHOOD POPULATIONS WITH SIGNIFICANT RISK FACTORS TO BE TARGETED BY INTERVENTIONS.

Negative Pregnancy Outcomes				
	Maternal Health and Prematurity		Maternal Care	Infant Health
Population	Very Low Birth Weight Birth	Very Low Birth Weight Fetal or Infant Death	Higher Birth Weight Fetal Death	Higher Birth Weight Post-Neonatal Death (28 days to 1 Year of Age)
Mothers with a High School Degree or Less Education	Too few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Previous premature or small-for-gestational-age baby.		Inadequate prenatal care. Premature or small-for-gestational-age baby.	

Note. The risk factors are not listed in order of importance. Very low birth weight is less than 1500 grams (3.3 lbs.) and higher birth weight is 1500 grams or more. African American women in Maryvale had high excess mortality rates but the numbers were statistically too small to examine in Phase II analyses. Please see Maricopa County results to target African American mothers in Maryvale.

South Phoenix

Phase I

- The total feto-infant mortality rate from 1996 through 2000 was 10.6 deaths (per 1,000 live births and fetal deaths), which was higher than the county rate.
- The excess feto-infant mortality rate during the period was 4.8 deaths (per 1,000 live births and fetal deaths), suggesting that **45% of the fetal and infant deaths were potentially preventable.**
- The highest excess group-specific rate was “maternal health/prematurity,” while the second highest rate was “maternal care.”
- The excess death rate was higher for women 20 or more years of age (5.0) than for women under the age of 20 (4.1), however, this finding is opposite from the expected and the sample size was small for the younger women. For both groups, the highest rate was “maternal health/prematurity.”
- **The excess F-IMR for women with a high school education or less (6.4) was six times higher than the excess rate for women with some education beyond high school (1.0).** For the lower education group, the highest excess group-specific rates were in the “maternal health/prematurity” and “maternal care” categories.

- **African Americans and Native Americans were analyzed as a single group in Phase I because the numbers were small and the patterns were similar. This group had an excess F-IMR of 7.7, which was higher than the excess F-IMR for Hispanics (4.3).**
 - The African/Native American women’s highest excess group-specific rate was in “infant health.”
 - Hispanic women’s highest excess rate was in “maternal health/prematurity.”

Phase II

The table on the following page identifies risk factors for the targeted populations in the South Phoenix area and the Phase I findings in that area.

SOUTH PHOENIX AREA POPULATIONS WITH SIGNIFICANT RISK FACTORS TO BE TARGETED BY INTERVENTIONS.

Negative Pregnancy Outcomes				
	Maternal Health and Prematurity		Maternal Care	Infant Health
Populations	Very Low Birth Weight Birth	Very Low Birth Weight Fetal or Infant Death	Higher Birth Weight Fetal Death	Higher Birth Weight Post-Neonatal Death (28 days to 1 Year of Age)
South Phoenix Overall	Few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.	Few prenatal care visits. Fever during labor and delivery.	Inadequate prenatal care. Maternal diabetes. Premature or small-for-gestational-age baby.	
Teenage mothers	Few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.			Few prenatal care visits.
Mothers 20 or more years of age	Few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.	Few prenatal care visits.	Inadequate prenatal care. Maternal diabetes. Premature or small-for-gestational-age baby.	
Mothers with a high school degree or less education	Few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.	Few prenatal care visits.	Inadequate prenatal care. Premature or small-for-gestational-age baby.	
Hispanic Mothers	Few prenatal care visits. Less than 15 lbs. weight gain during pregnancy. Lack of social support and SES advantages (unmarried mother). Premature or small-for-gestational-age baby.	Few prenatal care visits. Fever during labor and delivery.	Inadequate prenatal care. Maternal diabetes. Premature or small-for-gestational-age baby.	

Note. The risk factors are not listed in order of importance. Very low birth weight is less than 1500 grams (3.3 lbs.) and higher birth weight is 1500 grams or more. African American and Native American women in South Phoenix had high excess mortality rates but the numbers were statistically too small to examine in Phase II analyses. Please see Maricopa County results to target these two groups of mothers in South Phoenix.

Section II. Perinatal Periods of Risk Overview

The Perinatal Periods of Risk (PPOR) is a multidisciplinary approach to understanding the complex issues contributing to fetal and infant mortality. This approach translates natality, mortality, and morbidity data into useful information for health workers, policy makers, and communities. The goal of PPOR is to prioritize and target prevention and intervention efforts where they may be most effective.

Dr. Brian McCarthy and colleagues in the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) developed the framework for PPOR and applied the approach in developing and developed countries. Research to validate the approach in U.S. cities began in 1997 as a collaborative effort among CityMatCH, the University of Nebraska Medical Center, CDC, National March of Dimes, and the Health Resources and Services Administration: Maternal and Child Health Bureau. Maricopa County participated as one of the 15 original urban areas.

There are two equally important components to the PPOR approach: 1) analyzing data to identify intervention areas in the health care system during the perinatal period of time; and, 2) community mobilization to facilitate a sustained effort to reduce fetal and infant mortality. Both of these components happen simultaneously, interacting and learning from one another to build a richer understanding of the problem and indicate possible directions for action.

The data analysis component of PPOR has two phases. In the first phase, fetal and infant mortality (feto-infant mortality) are mapped to four categories that correspond to specific intervention points in the health care continuum, and suggests where to focus prevention or intervention efforts. Phase II analyses attempt to ascertain potential reasons for the excess mortality in the categories with the highest excess rates. The approach to the analysis depends on the results of Phase I, available data on risk factors, and community information.

Phase I begins by calculating fetal and infant mortality (feto-infant mortality). The overall feto-infant mortality rate is then divided into four categories based on the age at death and birth weight of the child. These four categories include: maternal health/prematurity, maternal care, newborn care, and infant health. Figure 1 shows the map of feto-infant mortality.

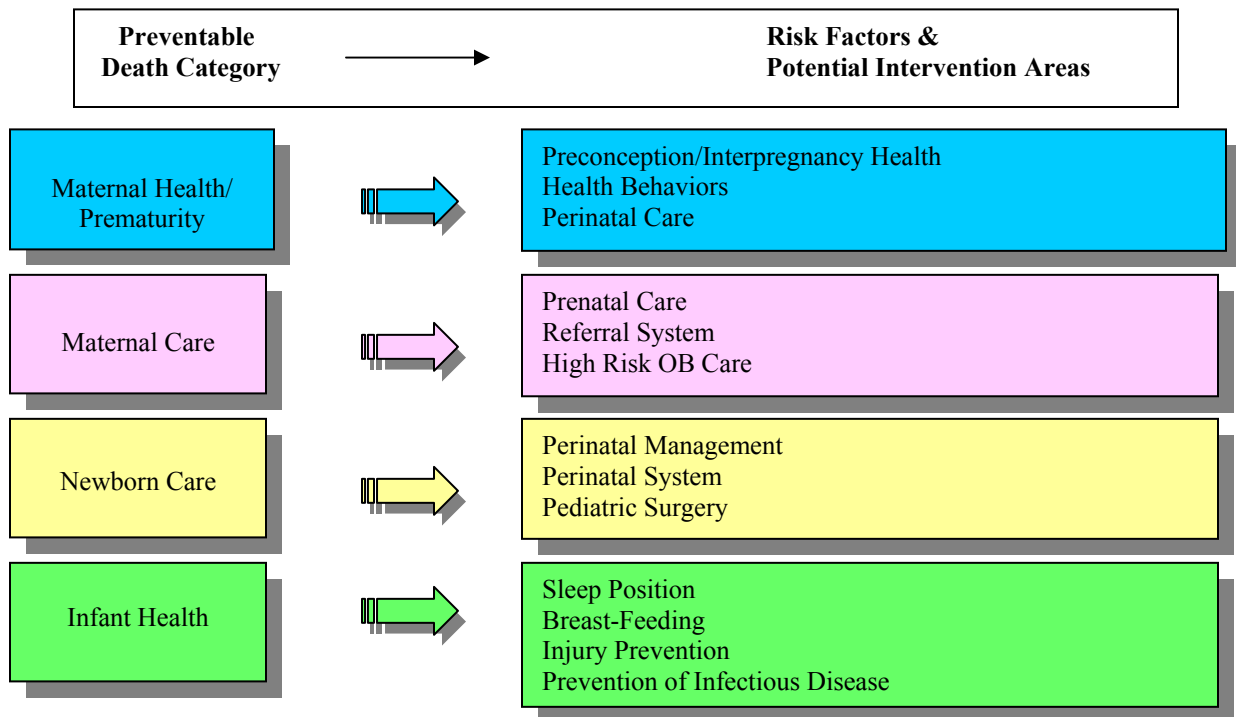
The age at death is categorized into three groups: a) fetal deaths are those deaths that occur between 24 weeks gestation and birth, b) neonatal deaths are those deaths that occur between birth and the first 28 days of life, and c) post-neonatal deaths occur between 28 days of life and one year of life. Birth weight is categorized into very low birth weight births (500-1499 grams/1.1-3.3 lbs) and all other births (1500 grams/3.3 lbs or more).

Figure 1. Map of Feto-Infant Mortality
Age at Death

<i>Birth Weight</i>	<i>Age at Death</i>		
	<i>Fetal</i>	<i>Neonatal</i>	<i>Post-neonatal</i>
500-1499 grams 1.1–3.3 lbs.	Maternal Health / Prematurity		
1500+ grams 3.3+ lbs.	Maternal Care	Newborn Care	Infant Health

In Figure 2, each of the categories is shown connected to areas that may be considered for prevention or intervention. For example, any fetal or infant death prior to one year of age in which the baby weighed between 500-1499 grams corresponds to the “maternal health/prematurity category.” Deaths that fall into this category are associated with the mother’s health prior to conception, the mother’s overall health behaviors (e.g., smoking or pregnancy intendedness), or perinatal care. Therefore, if most feto-infant deaths fall into this category, prevention and intervention efforts may need to focus on one or more of these areas.

Figure 2. Map Connections to Action



After feto-infant mortality rates for the select population groups have been calculated and parceled into the different categories, this data is then compared to the data of a reference group. The reference group is chosen based on its low feto-infant mortality rate, as the approach assumes that the whole population should be able to experience the same low feto-infant mortality rate as any group within the population. The purpose of comparison is to provide an estimate of the amount of fetal and infant mortality that is preventable (excess mortality). The

analyses then continue to ascertain the reasons for the excess mortality in the categories with the highest excess rates.

Phase II analyses attempt to ascertain potential reasons for the excess mortality in the categories with the highest excess rates. The approach to the analysis depends on the results of Phase I, available data on risk factors, and community information. Phase II helps to clarify risk factors for efficient and effective intervention targeting. Each potential area of excess (“maternal health and prematurity”, “maternal care”, “newborn care”, and “infant health”) has a slightly different analysis method in Phase II. Although the analyses of each category begin differently, all of the analyses eventually focus on risk factors to be targeted for intervention by the community.

After determining the associated risk factors (according to previous research and literature) for each death category, two questions are asked:

- 1) Are there differences between the group of interest and the reference group in the distribution of these risk factors?
- 2) Are these risk factors associated with death or very low birth weight in this population?

To answer the first question, risk factors are identified and the distributions for the reference group and the group of interest are compared with Goodness of Fit Chi-Square statistics. To answer the second question, univariate and adjusted logistic regression analyses are conducted to identify the risk factors that predict the outcome in this population.

The deaths attributed to “maternal health and prematurity” are very low birth weight (VLBW) deaths of any age, as determined in Phase I. The first step is to determine whether the deaths are due to the selected population group having more very low birth weight babies than the reference group or due to the selected population group having more babies dying at the same birth weight as compared to the reference group. These two pathways tend to have different risk factors and causes of death, so different interventions may be necessary.

When the “maternal health and prematurity” deaths are mainly associated with the too many VLBW babies pathway, the associated risk factors tend to be related to the mother’s health, behavior, social and economic situation. The factors examined include marital status, high parity for age, multiple birth (e.g., twins), prenatal care, prematurity, previous preterm infant, small for gestational age, anemia, pregnancy weight gain, tobacco use, alcohol use, and method of payment for delivery. Additional but unavailable risk factors include sexually transmitted disease, infections such as bacterial vaginosis, drug abuse, pregnancy intendedness, domestic violence, income, and the social capital of the community (SES indicator).

Marital status could be seen as a proxy for social support and socioeconomic status (SES). It seems unlikely that forcing marriage could improve low birth weight. However, eliminating those factors that may make women who are unmarried more susceptible to the poor birth outcome of VLBW (e.g., socioeconomic conditions, social and parenting support, unplanned pregnancy) could potentially prevent VLBW babies.

When the deaths attributed to “maternal health and prematurity” are associated with more babies dying at the same birth weight, the risk factors tend to be related to the medical care provided to

the mother and infant before, during, and immediately after the birth. The PPOR approach suggests examining the risk factors associated with more babies dying at the same birth weight whenever 40% or more of the “maternal health/prematurity” excess death rate is attributable to this contributing pathway. It is likely easier to change risk factors related to medical care than those associated with the mothers social and economic situation. The risk factors examined included maternal age, maternal education, maternal race/ethnicity, hospital perinatal care designation level, prematurity, small-for-gestational-age baby, congenital anomalies (as a group), fever during labor and delivery (indication of infection), placenta previa (abnormal implantation of the placenta so that it tends to precede the baby at delivery) and abruptio placenta (premature separation of the placenta), premature rupture of the membranes, precipitous labor (quick labor lasting less than three hours), dysfunctional labor, fetal malpresentation (e.g., breech), cord prolapse (premature expulsion of the umbilical cord in labor before the fetus is delivered), fetal distress (signs indicating that the fetus is not receiving enough oxygen), maternal diabetes, pregnancy induced hypertension, infant transferred to another facility, mother transferred to another facility, assisted ventilation for the newborn, prenatal care, and method of payment. Additional risk factors that were unavailable for analysis included stage of labor upon hospital admission, Group B strep screen, and prenatal steroids.

The deaths attributed to “maternal care” are the larger birth weight (>1500 grams) fetal deaths. Potential risk factors that may increase the risk of fetal death but were not readily available for analysis include maternal infection, maternal injury, delays in obtaining medical care for prenatal care or delivery, delays in recognizing potential problems such as decreased fetal activity, inadequate referral systems, and inadequate monitoring. The risk factors selected for analysis that were available on the fetal death certificate included age, education, race/ethnicity, the number of prenatal care visits, the trimester that prenatal care began, adequacy of prenatal care utilization index (APNCUI; describes the adequacy of the timing of prenatal care initiation and the number of visits), hospital perinatal service level, prematurity, small for gestational age, placenta previa (abnormal implantation of the placenta) or abruptio placenta (premature separation of the placenta), fetal malpresentation (e.g., breech), cord prolapse (premature expulsion of the umbilical cord in labor before the fetus is delivered), fetal distress (signs indicating that the fetus is not receiving enough oxygen), maternal diabetes, and pregnancy-related hypertension.

“Infant health” deaths comprise the larger babies (at least 1500 grams) who die later in infancy (from 28 days to one year). Further exploration of the deaths in the “infant health” category begins with a cause of death analysis because different risk factors will be important for different causes of death. The CDC published an analysis of post-neonatal mortality in which specific causes of death are grouped into broader, causally associated categories. These were the categories used for this analysis. The risk factor analyses follow the same methods as the other categories except that the risk factors are specific to the main causes of death. The factors examined included age, education, race/ethnicity, prenatal care utilization, smoking during pregnancy, drinking alcohol during pregnancy, diabetes, and ultrasound. Additional factors that were unavailable included high risk follow-up, medical home, drug use, folic acid intake, alpha-feto protein, genetic counseling, breast-feeding, immunizations, sleep position, bedding, death scene investigation, co-sleeping, car seat use, abuse, supervision, and the environment.

Deaths attributed to the “newborn care” category include larger babies (at least 1500 grams) who die between birth and 28 days of life. Additional analyses of the newborn care category also follow a cause of death categorization. The analyses proceed similarly to the “infant health” category.

Phase II consisted of many analyses, tables, and graphs. To simplify the report, the main findings are summarized in this abridged version. The summary consists of risk factors that met two conditions: a) Maricopa County women with these risk factors were more likely to have a poor birth outcome, and b) compared with the reference group, there was a higher prevalence (percent) of the risk factor in the group of women with high excess mortality.

Section III. PPOR: Maricopa County Results

Phase I: Feto-Infant Mortality

During the period 1996 to 2000, there were a total of 1,925 fetal and infant (feto-infant) deaths and 226,259 live births and fetal deaths in Maricopa County. The corresponding total feto-infant mortality rate (F-IMR) in the county was 8.5 deaths per 1,000 live births and fetal deaths. This means that for every 1,000 recognized pregnancies with 6 months or more gestation, 8.5 resulted in either a fetal death or the death of a baby.

Figure 3 shows the county's PPOR analysis for the years 1996 through 2000 combined. The overall F-IMR is divided into four cells that suggest the prevention/intervention for the deaths in that group. The mortality rates in the four cells sum to the total feto-infant mortality rate. The highest group-specific feto-infant mortality rate of 2.8 deaths per 1,000 live births and fetal deaths occurred in the "maternal health and prematurity" category. In other words, "maternal health/prematurity" contributed 2.8 deaths to the total rate of 8.5 deaths. The second highest group-specific F-IMR was 2.1 in the "maternal care" category. The F-IMR was 1.8 for both the "newborn care" and "infant health" categories.

Figure 3. Maricopa County's Feto-Infant Mortality Rate (1996-2000)

Total F-IMR=8.5

		<i>Age at Death</i>		
		<i>Fetal</i>	<i>Neonatal</i>	<i>Post-Neonatal</i>
<i>Birth Weight</i>	500-1499 g.	Maternal Health/Prematurity 2.8		
	1500+ g.	Maternal Care 2.1	Newborn Care 1.8	Infant Health 1.8

During the same time period, 1996 to 2000, the reference group had a total F-IMR of 5.8 deaths per 1,000 live births and fetal deaths. There were a total of 571 feto-infant deaths and 98,823 live births and fetal deaths during the period among this group. Figure 4 shows the reference group's feto-infant mortality. Similar to Maricopa County, the highest group-specific F-IMR was in the "maternal health/prematurity" category (1.9 deaths per 1,000 live births and fetal deaths).

Figure 4. Reference Group's Feto-Infant Mortality Rate (1996-2000)
(Maricopa County White Women who were 20 or more years of age and had some education beyond High School)

Total F-IMR = 5.8

		<i>Fetal</i>	<i>Neonatal</i>	<i>Post - Neonatal</i>
Birth Weight	500-1499 g.	Maternal Health/Prematurity 1.9		
	1500+ g.	Maternal Care 1.0	Newborn Care 1.5	Infant Health 1.4

Excess (Preventable) Feto-Infant Mortality

Figure 5 shows the excess feto-infant mortality in the county, as well as the method to obtain the excess. On the far left is the county's F-IMR (same as Figure 3), the middle figure shows the reference group's F-IMR (same as Figure 4), and on the far right is the excess F-IMR for the county. Subtracting the reference group's F-IMR (5.8) from the county's F-IMR (8.5) yielded an excess (preventable) F-IMR of 2.7 deaths per 1,000 live births and fetal deaths. The excess F-IMR can be described as an "opportunity gap" and shows disparities within the population. The amount of excess mortality suggests the extent to which the F-IMR could be theoretically reduced in the county. If the F-IMR did not differ across groups, then there would have been 2.7 fewer feto-infant deaths per 1,000 live births and fetal deaths in the county during the period 1996 to 2000.

Figure 5. Maricopa County Opportunity Gap (Excess Feto-Infant Mortality Relative to the Reference Group) Potential for Reduction

<i>Maricopa County</i>		<i>Reference</i>		<i>Excess</i>																		
Total F-IMR = 8.5	-	5.8	=	2.7																		
<table><tr><td colspan="3">2.8</td></tr><tr><td>2.1</td><td>1.8</td><td>1.8</td></tr></table>	2.8			2.1	1.8	1.8	-	<table><tr><td colspan="3">1.9</td></tr><tr><td>1.0</td><td>1.5</td><td>1.4</td></tr></table>	1.9			1.0	1.5	1.4	=	<table><tr><td colspan="3">1.0</td></tr><tr><td>1.1</td><td>0.3</td><td>0.4</td></tr></table>	1.0			1.1	0.3	0.4
2.8																						
2.1	1.8	1.8																				
1.9																						
1.0	1.5	1.4																				
1.0																						
1.1	0.3	0.4																				

* Numbers may not add exactly due to rounding

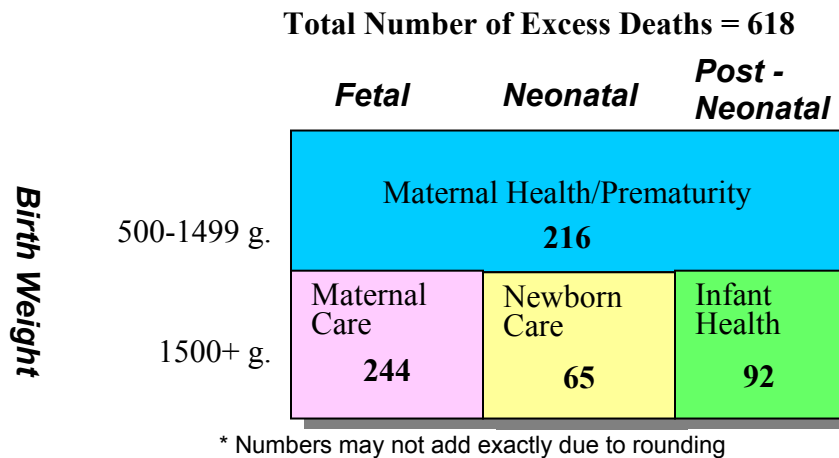
Opportunity Gap

The same method was applied to each of the prevention/intervention cells to determine which areas had the highest excess rates. Both the county and the reference group showed the highest F-IMR in the "maternal health and prematurity" category; however, the highest excess group-specific rate was in the "maternal care" category (excess rate of 1.1 deaths per 1,000 live births and fetal deaths). The lowest excess F-IMR rate occurred in the "newborn care" category with 0.3 deaths per 1,000 live births and fetal deaths.

If the whole county's F-IMR was similar to the reference group's F-IMR, there would have been 618 fewer fetoinfant deaths in the five-year period than actually occurred. This suggests that 32% of the fetal and infant deaths in Maricopa County were potentially preventable.

See Figure 6 for the translation of excess rates into number of excess deaths during the five-year period. These excess deaths represented 32.1% of the fetoinfant mortality in Maricopa County during the period 1996 through 2000.

**Figure 6. Maricopa County Potential for Reduction:
Excess Rates Expressed as Number of Deaths**



Successful prevention and intervention efforts focused on “maternal care” and “maternal health/prematurity” should yield larger reductions in the overall excess fetoinfant mortality rate.

Excess Feto-Infant Mortality for Selected Population Groups

The excess rates were also examined by population groups to determine which groups contributed more to the excess fetoinfant mortality. Risk factors within each population group can affect fetoinfant mortality. This knowledge allows prevention efforts to be further focused on those population groups with higher mortality rates.

Excess Feto-Infant Mortality by Age Group

Maternal age was categorized into two groups: women under 20 years old (teenagers) and women 20 or more years of age. Figure 7 shows the excess fetoinfant mortality rate for women less than 20 years of age and women 20 or more years of age. For teenagers, there were a total of 360 fetoinfant deaths and 30,941 live births and fetal deaths. For women 20 or more years of age, there were a total of 1,563 fetoinfant deaths and 195,207 live births and fetal deaths.

The excess F-IMR for Maricopa County women less than 20 years of age was more than twice the excess rate for older women.

Prevention efforts targeting “infant health” in Maricopa County need to be distributed, taking into consideration high rates in one population and a high number of deaths in the other population. Although the excess rate in the “infant health” category was higher for teenagers (rate of 1.5 versus 0.2), the number of feto-infant deaths for women 20 or more years of age was higher (360 versus 1,563 feto-infant deaths).

Figure 7. Maricopa County Excess Feto-Infant Mortality Rate (Number of Deaths) by Age Group (1996-2000)

< 20 years old (rate=5.9, N=181)			= > 20 years old (rate=2.2, N=435)		
Maternal Health/Prematurity 2.41 (75)			Maternal Health/Prematurity 0.72 (141)		
Maternal Care 1.16 (36)	Newborn Care 0.83 (26)	Infant Health 1.46 (45)	Maternal Care 1.06 (208)	Newborn Care 0.20 (40)	Infant Health 0.24 (47)

Excess Feto-Infant Mortality by Education Group

Figure 8. Maricopa County Excess Feto-Infant Mortality Rate (Number of Deaths) by Education Group (1996-2000)

< = 12 years (rate=7.1, N=465)			> 12 years (rate=0.38, N=59)		
Maternal Health/Prematurity 2.47 (162)			Maternal Health/Prematurity 0.13 (20)		
Maternal Care 3.12 (205)	Newborn Care 0.52 (34)	Infant Health 0.99 (65)	Maternal Care -0.03 (-4)	Newborn Care 0.14 (22)	Infant Health 0.14 (22)

The level of maternal education was dichotomized into two groups: women with a high school degree or less education (≤ 12 years) and women with any education beyond high school (> 12 years). There were a total of 844 and 952 feto-infant deaths and 65,524 and 154,567 live births and fetal deaths for women with a high school education or less and women with some education beyond high school, respectively. The excess rate of feto-infant deaths varied considerably with maternal education level (see Figure 8).

The excess F-IMR for Maricopa County women with a high school degree or less education was 18 times higher than women with more education.

It is important to point out that education is an antecedent factor for other measures such as income levels, access to care, and behavioral patterns and a proxy measure for socioeconomic status (SES). Therefore, increasing the population's education level would not necessarily decrease all the risk factors for feto-infant mortality but it would help to improve outcomes dependent on incomes, behaviors, and access to care. For women with a high school education or less, the “maternal care” (3.1 deaths per 1,000 live births and fetal deaths) and “maternal health/prematurity” (2.5 deaths per 1,000 live births and fetal deaths) categories showed the highest excess F-IMRs.

Excess Feto-Infant Mortality by Race/Ethnic Groups

Figure 9 shows the county's excess feto-infant mortality for race/ethnic groups. Race/ethnicity in the U.S. society can be a proxy measure for many risk factors such as socioeconomic status, living conditions, cultural and behavioral patterns, and life stressors. The number of feto-infant deaths and the number of live births and fetal deaths, respectively, was 118 and 8,466 for non-Hispanic African Americans, 63 and 6,246 for non-Hispanic Native Americans, 798 and 86,380 for Hispanics, and 903 and 117,751 for non-Hispanic Whites.

**The excess feto-infant mortality rate among African Americans
far exceeds any other race/ethnic group.**

The overall excess feto-infant mortality rate was highest among African Americans (8.2 deaths per 1,000 live births and fetal deaths), followed by Native Americans (4.3 deaths per 1,000 live births and fetal deaths), Hispanics (3.5 deaths per 1,000 live births and fetal deaths), and then Whites (1.9 deaths per 1,000 live births and fetal deaths).

**Figure 9. Maricopa County Excess Feto-Infant Mortality Rate
(Number of Deaths) by Race/Ethnicity (1996-2000)**

	Total	MH/P	MC	NC	IH
Hispanic	3.46 (299)	1.39 (120)	1.38 (119)	0.40 (35)	0.29 (25)
African American	8.16 (69)	3.58 (30)	0.97 (8)	0.86 (7)	2.75 (23)
Native American	4.31 (27)	0.87 (5)	1.52 (9)	0.26 (2)	1.66 (10)
White	1.89 (223)	0.57 (67)	0.86 (101)	0.16 (19)	0.30 (36)

Note. “Total” is the overall excess F-IMR, “MH/P” refers to maternal health and prematurity; “MC” refers to maternal care, “NC” refers to newborn care, and “IH” refers to infant health.

Each race/ethnicity showed a different pattern of findings suggesting that programs should consider targeting these groups differently.

Summary of Phase II Results

In Phase II, the analyses focus on potential risk factors for those areas with excess mortality. In order to conduct the Phase II analyses, there need to be large enough numbers of births and deaths in the group, such as teenagers, with excess mortality (at least 60) and the preventable death rate needs to be large enough within a category (at least 1.5) in order for the statistical methods used to be reliable.

Table 1 shows the Maricopa County summary of groups with excess fetal and infant death rates by category from the Phase I analyses. The groups and categories that met the criteria for further analyses are shown with a check mark (✓). For the “maternal health and prematurity” category, women with a high school education or less, teenagers, and African American women met the criteria for further analyses. For the “maternal care” category, analyses concentrate on women with a high school education or less and Native American women. “Infant health” category analyses concentrate on teenagers, African Americans, and Native Americans. The “newborn care” category did not meet the criteria for further analyses in any of the groups examined. As discussed in the Overview section, only summaries of the Phase II analyses are presented here. Please see the complete document for analyses and methods.

Table 1. Summary of Population Groups with Excess Mortality by Category from the Phase I Results that will be Examined in Phase II (Groups with Check Marks).

Maricopa County Group	Maternal Health & Prematurity	Maternal Care	Newborn Care	Infant Health
<i>All mothers</i>				
< 20 years old	✓			✓
≥ 20 years old				
≤ 12 years Education	✓	✓		
>12 years Education				
White				
Hispanic				
African American	✓			✓
Native American		✓		✓

Maternal Health and Prematurity

The first step in describing the reasons for the excess “maternal health and prematurity” death rate is determining whether this excess is due to more VLBW babies or more babies dying at each birth weight. For teenagers, seventy percent of the “maternal health and prematurity” excess

rate was because teenagers had more VLBW babies than the reference group. For women with a high school education or less, more than half (56%) of the “maternal health/prematurity” mortality rate was due to too many VLBW babies and 44% was due to high mortality at VLBW. There were more VLBW babies in the African American group than in the reference group, however the births to African American women in Maricopa County show better survival at each VLBW range than the births to women in the reference group.

In all three Maricopa County population groups with high excess mortality in the “maternal health and prematurity” category, the analyses suggested that attention should focus on those risk factors that affect too many VLBW babies being born to these groups of women.

Analysis of risk factors that may affect high mortality at VLBW for Maricopa County women with a high school education or less was undertaken. These risk factors were not examined for the other two groups with high rates of excess mortality in the “maternal health/prematurity” category because the groups did not have 40% or more of excess rate due to high mortality at VLBW.

Table 2 shows those risk factors deemed important by each pathway to excess mortality in the “maternal health/prematurity” category. For a list of the risk factors analyzed, see the Overview section.

Table 2. Summary of Important Risk Factors for Deaths in the “Maternal Health/Prematurity” Category.

Risk Factors	More VLBW Babies (Maternal Health)		
	Teenagers	≤ 12 Yrs Education	African American
IUGR/SGA*	✓	✓	✓
Prematurity	✓	✓	✓
Unmarried (social support/SES)	✓	✓	✓
Smoking		✓	✓
Weight Gain < 15 lbs.	✓	✓	✓
Few Prenatal Care Visits	✓	✓	✓
High Mortality at VLBW (Perinatal Conditions/Care)			
Hospital Service Level		✓	
Few Prenatal Care Visits		✓	
Fever During Labor/Delivery		✓	
Assisted Ventilation		✓	

Note. Check marks indicate the risk factor is important for deaths in the “maternal health/prematurity” category.

*Intrauterine growth retardation/small for gestational age

For higher numbers of VLBW babies, the risk factors deemed important (the Overview discusses the definition) for this population consisted of small for gestational age, prematurity, unmarried, smoking, less than 15 lbs. pregnancy weight gain, and few or no prenatal care visits. Smoking does increase the chances of having a VLBW baby. Smoking cigarettes was not checked for teenagers in the table because teenagers did not smoke more than the reference group. In each group including the reference group, at least 8% of the women smoked during pregnancy. This suggests that there is room to reduce these smoking rates further.

Maternal Care

Deaths in the “maternal care” category are fetal deaths weighing 1500 grams or more. For the “maternal care” category, analyses concentrate on women with a high school education or less

and Native American women. Of the risk factors analyzed, several predicted the deaths in the “maternal care” category and also were more prevalent in the groups with high excess mortality in the category; these risk factors are shown in Table 3.

Table 3. Summary of Important Risk Factors for Deaths in the “Maternal Care” Category		
Risk Factors	≤ 12 Yrs Education	Native American
Inadequate Prenatal Care	✓	✓
Small for Gestational Age	✓	✓
Maternal Diabetes		✓
Prematurity	✓	

Note. Check marks indicate the risk factor is important.

The important risk factors that are subject to change included inadequate prenatal care and lower educational level. Women who received adequate levels of prenatal care, as defined by American College of Obstetricians and Gynecologists (ACOG), and/or had some education

beyond high school were less likely to have a higher birth weight fetal death. Diabetes was a risk factor for the Native American women. Although all diabetes cannot necessarily be prevented at this point, there are health behaviors that increase the risk of diabetes.

Newborn Care

Phase I analyses indicated that there was not much variability in the “newborn care” category among the different groups of mothers. The excess mortality did not meet the criterion of 1.5 deaths per 1,000 live births and fetal deaths in any of the groups examined. These results suggest that newborn care was not an issue in Maricopa County. Therefore, Phase II analyses of the “newborn care” category were not conducted.

Infant Health

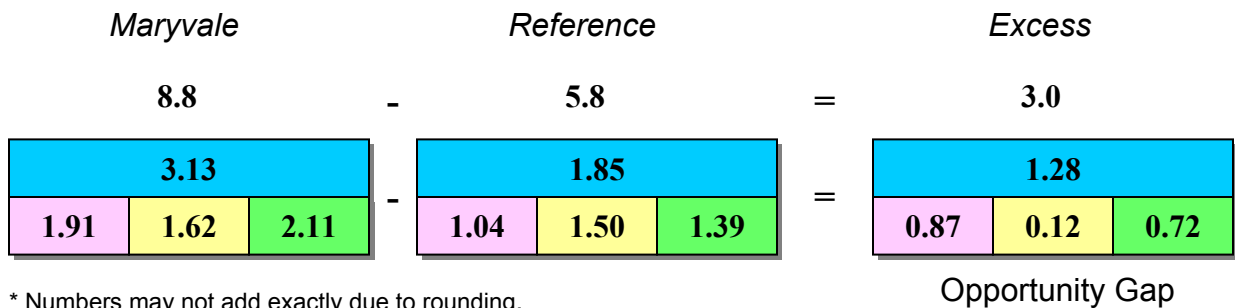
Deaths attributed to “infant health” are those deaths that occur to larger babies (> 1500 grams) from 28 days and one year of life. The first analysis for excess death in the “infant health” category was an examination of the underlying cause of death. The basis of the classification of the causes of death into larger categories was a classification by the CDC for the purposes of post-neonatal mortality surveillance. See Table 4 for a brief explanation of each category.

Table 4. Underlying Cause of Death (COD) Categories Used for Classification of the Deaths Due to “Infant Health” Risk Factors and Causes.	
COD Category	Description
Perinatal Conditions	Deaths due to perinatal conditions include those due to maternal factors and complications of pregnancy, disorders of gestation and fetal growth, birth trauma, specific respiratory, cardiovascular and infectious conditions specific to perinatal period, hemorrhagic and hematological disorders of the newborn, and endocrine and metabolic disorders
Congenital Conditions	Birth defects are physical or mental disabilities that may be fatal. A few examples are Spina Bifida, Downs Syndrome, and Cleft Palate but thousands of birth defects are currently known.
Infections	Include respiratory, gastrointestinal, central nervous system, septicemia, and others.
SIDS	The unexpected, sudden death of an infant under one year of age that continues to be unexplained after a complete investigation
Injuries	Consist of homicide, motor vehicle accidents, poisoning, falls, fire, drowning, suffocation, and other unintentional injuries.
Ill-defined	Ill-defined deaths include other symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified.
Other	All other causes of death that do not fit into the classification scheme are included in the other category.

The two leading causes of mortality in the “infant health” category for the county as a whole were infections and Sudden Infant Death Syndrome (SIDS). These were also the two leading causes of death for those groups with a high excess mortality rate in the “infant health” category: Teenagers, African Americans, and Native Americans. Only two risk factors other than maternal demographic characteristics were examined because many of the risk factors for these deaths tend to be environmental and not reported during vital registration. Few or no prenatal care visits was an important risk factor for infections. Both smoking during pregnancy and few (or no) prenatal care visits were important risk factors for SIDS. Although smaller percentages of teenagers and Native Americans smoked than women in the reference group, over 8% of teenagers and reference group women smoked and 5.8% of Native American women smoked. Therefore, these rates could be reduced. Smoking during pregnancy increases the risk for both SIDS and reduced lung function in the baby. Second-hand smoke exposure also increases the risk for both SIDS and asthma later in life.

described as an “opportunity gap” and shows disparities within the population. The amount of excess mortality suggests the extent to which the F-IMR can be theoretically reduced in Maryvale. The highest group-specific F-IMR was found in the “maternal health/prematurity” category. This is a conservative estimate of the actual excess; the reference group was not removed from the Maryvale numbers. Although Maryvale’s F-IMR was similar to the county’s, the excess death rate of 3 (per 1,000 live births and fetal deaths) suggests that there is room to reduce the fetio-infant mortality rate in the area.

Figure 10. Maryvale Opportunity Gap (Excess Feto-Infant Mortality Relative to the Reference Group), Potential for Reduction



Each of the group-specific rates was subtracted from the corresponding group rate. The largest excess rate was in the “maternal health/prematurity” category with 1.28 deaths per 1,000 live births and fetal deaths. “Maternal care” showed an excess rate of 0.87, “infant health” an excess rate of 0.72, and “newborn care” an excess rate of 0.12 deaths per 1,000 live births and fetal deaths.

If Maryvale’s F-IMR was similar to the reference group’s F-IMR, there would have been 61 fewer fetio-infant deaths in the five-year period than actually occurred. This suggests that 34.1% of the fetal and infant deaths in Maryvale were potentially preventable.

See Figure 11 for the translation of rates into number of deaths over the five-year period.

**Figure 11. Maryvale Potential for Reduction:
Excess Rates Expressed as Number of Deaths**

Total Number of Excess Deaths = 61

		<i>Fetal</i>	<i>Neonatal</i>	<i>Post Neonatal</i>
<i>Birth Weight</i>	500-1499 g.	Maternal Health/Prematurity 26		
	1500+ g.	Maternal Care 18	Newborn Care 2	Infant Health 15

* Numbers may not add exactly due to rounding.

These findings suggest that successful prevention and intervention efforts focused on the “maternal health/prematurity” category should yield larger reductions in the overall excess feto-infant mortality rate in Maryvale.

Excess Feto-Infant Mortality for Selected Population Groups

The excess rates were also examined by population groups to determine which groups contribute more to the excess feto-infant mortality. Risk factors within each population group can affect infant mortality. This knowledge allows prevention efforts to be further focused on those groups with higher mortality rates.

Excess Feto-Infant Mortality by Age Group

The total excess F-IMR for teenagers was very similar to the rate for women 20 or more years of age in Maryvale (3.0 and 2.9 deaths per 1,000 live births and fetal deaths, respectively) and the pattern of results was the same. For further discussion, view entire PPOR report at www.maricopa.gov/public_health/epi.

Excess Feto-Infant Mortality by Education Group

The level of maternal education was categorized into two groups: women with a high school education or less (≤ 12 years) and women with any education beyond high school (> 12 years). There were a total of 102 feto-infant deaths and 9,796 live births and fetal deaths for women with a high school education or less. For women with some education beyond high school, there were a total of 58 feto-infant deaths and 10,069 live births and fetal deaths. Figure 12 shows the excess feto-infant mortality for both education levels. There was a large difference in the total excess F-IMRs between the two education groups; the excess death rate for women with a high school education or less was 4.6 deaths per 1,000 live births and fetal deaths, while there was essentially no excess for women with some education beyond high school. For those with a high school education or less, the highest excess rate was in “maternal health/prematurity.”

The excess F-IMR for Maryvale women with a high school education or less was 4.6, while there was no excess for more educated women.

It is important to point out that education is an antecedent factor for other measures such as income levels, access to care, and behavioral patterns and a proxy measure for socioeconomic status (SES). Therefore, increasing the population's education level would not necessarily decrease all the risk factors for feto-infant mortality but it may help to improve outcomes dependent on incomes, behaviors, and access to care.

**Figure 12. Maryvale's Excess Feto-Infant Mortality Rate
(Number of Deaths) by Education Group (1996-2000)**

< = 12 years (4.6 rate, N=102)			> 12 years (-0.02 rate, N=58)		
Maternal Health/Prematurity 2.33 (23)			Maternal Health/Prematurity -0.26 (-3)		
Maternal Care 1.51 (15)	Newborn Care -0.07 (-1)	Infant Health 0.86 (8)	Maternal Care -0.05 (0)	Newborn Care -0.01 (0)	Infant Health 0.30 (3)

Excess Feto-Infant Mortality by Race/Ethnicity Groups

Analyses were also conducted for racial/ethnic groups. During the five year period, there were a total of 116 feto-infant deaths and 13,383 live births and fetal deaths for Hispanics; 40 feto-infant deaths and 4,647 live births and fetal deaths for non-Hispanic Whites; 17 feto-infant deaths and 1,340 live births and fetal deaths for African Americans; and 5 feto-infant deaths and 566 live births and fetal deaths for Native Americans. African Americans had the highest total excess F-IMR at 6.9 deaths per 1,000 live births and fetal deaths. The number of feto-infant deaths was too small to partition the overall rate into categories for African Americans. The total Native American rate was unstable due to the small number of births and feto-infant deaths to this population group in this area. See the Maricopa County results in Section III to target African Americans or Native Americans in the Maryvale area.

**Figure 13. Maryvale's Excess Feto-Infant Mortality
Rate (Number of Deaths) by Race/Ethnicity (1996-2000)**

Non-Hispanic White (2.8 rate, N=40)			Hispanic (2.9 rate, N=116)		
Maternal Health/Prematurity 0.73 (3)			Maternal Health/Prematurity 1.43 (19)		
Maternal Care 1.32 (6)	Newborn Care 0.01 (0)	Infant Health 0.77 (4)	Maternal Care 0.60 (8)	Newborn Care 0.29 (4)	Infant Health 0.56 (7)

Figure 13 shows Maryvale’s excess fetoinfant mortality for Whites and Hispanics. The overall excess F-IMR for Whites was almost identical to the Hispanic excess rate (2.8 and 2.9 deaths per 1,000 live births and fetal deaths, respectively). Although the overall excess rates were similar, the pattern of mortality differed. The highest group-specific excess F-IMR fell in the “maternal care” category for Whites but it fell in the “maternal health/prematurity” category for Hispanics.

**These findings suggest that successful prevention
and intervention efforts should be focused differently for
Whites and Hispanics in Maryvale.**

Summary of Phase II Results

In Phase II, the analyses focus on potential risk factors for those areas with excess mortality. In order to conduct the Phase II analyses, there need to be large enough numbers of births and deaths in the group, such as teenagers, with excess mortality (at least 60) and the preventable death rate needs to be large enough within a category (at least 1.5) in order for the statistical methods used to be reliable.

In Maryvale, the only group that met the PPOR criteria for the required minimum excess fetoinfant mortality and the minimum number of fetal and infant deaths was women with a high school education or less. Women with a high school education or less accounted for about $\frac{3}{4}$ of the total excess in Maryvale. Their highest category of excess mortality was in “maternal health and prematurity.” The second highest category of excess mortality was “maternal care.” Therefore, risk factor analyses focus on women with a high school education or less.

The number of fetal and infant deaths to teenage mothers was too small for further analyses (plus the excess rates in the categories did not reach the minimum rate necessary per PPOR methodology). Additionally, with the exception of Hispanics, the number of fetal and infant deaths to the different race/ethnic groups was too small for further analyses. Hispanic’s excess fetoinfant mortality rates did not warrant additional risk factor analyses.

Although their numbers were not large enough to further examine here, African Americans total excess fetoinfant mortality was quite high (excess rate of 6.9). Different methodologies would be necessary to examine African Americans and Native Americans in Maryvale in more detail (e.g., focus groups, fetal and infant mortality review, or child fatality review for the live births). See the results for all of Maricopa County for information on African American and Native American women.

Maternal Health and Prematurity

The first step in describing the reasons for excess “maternal health/prematurity” death rate is determining whether this excess is due to more very low birth weight (VLBW) babies or more babies dying at each birth weight as compared to the reference group. The pathway to excess “maternal health and prematurity” deaths was determined for Maryvale women with a high school education or less; the group with the highest excess F-IMR in the “maternal

health/prematurity” category. Much of the difference could be attributed to more VLBW babies among women with a high school education or less. Approximately ¾ of the excess death in the “maternal health and prematurity” category was a result of this. Therefore, risk factors associated with VLBW were examined.

Several risk factors were deemed important (the Overview discusses the definition) for excess mortality in the “maternal health and prematurity” category. Table 5 lists those risk factors. For a complete list of the risk factors analyzed, see the Overview section. For VLBW babies, the risk factors consisted of small for gestational age, prematurity, unmarried, less than 15 lbs. pregnancy weight gain, and few or no prenatal care visits.

Table 5. Summary of Important Risk Factors for Deaths in the “Maternal Health and Prematurity” Category

Risk Factors	≤ 12 Yrs Education
IUGR/SGA	✓
Prematurity	✓
Unmarried (social support/SES)	✓
Smoking	
Weight Gain < 15 lbs.	✓
Few or No Prenatal Care Visits	✓

Note. Check marks indicate the risk factor is important for deaths in the “maternal health/prematurity” category.

Smoking is listed as a risk factor but not checked because smoking during pregnancy contributes to VLBW but women with a high school education or less in Maryvale did not smoke more than women in the reference group. Over 8% of the women in both groups smoked during pregnancy, however. This

result suggests that there is potential to reduce the smoking rate in both groups of women.

Focusing prevention or intervention programs on women’s health prior to conception should yield larger reductions in the excess feto-infant mortality rate than focusing on other points in the health care continuum.

Maternal Care

Deaths associated with “maternal care” are higher birth weight (1500 grams or more) fetal deaths. Although this group consists of larger birth weights in this methodology, birth weights in the 1500 to 2500 gram range are still low and birth weights of at least 4250 grams are considered high birth weight. Both the low and high birth weight babies are at higher risk for complications than those between 2500 and 4250 grams.

Many risk factors for the higher birth weight fetal deaths are not available on vital records. Of the risk factors analyzed (see Overview for a list), several predicted deaths related to the “maternal care” category and also were more prevalent in Maryvale women with a high school education or less education; these risk factors are shown in Table 6.

Table 6. Summary of Important Risk Factors for Deaths in the “Maternal Care” Category

Risk Factors	≤ 12 Yrs Education
Inadequate Prenatal Care	✓
Small for Gestational Age	✓
Prematurity	✓

Note. Check marks indicate the risk factor is important

The important risk factors that are subject to change included inadequate prenatal care and lower educational level. Women who receive adequate levels of prenatal care (as defined by ACOG) or have some education beyond high school are less likely to have a higher birth weight fetal death.

Although maternal diabetes, placenta previa/abruptio, breech, and cord prolapse were significant risk factors for the deaths attributed to the “maternal care” category, Maryvale women with a high school education or less education did not have higher levels of the risk factor than women in the reference group.

Women with a high school education or less also had high excess mortality in the “maternal care” category, which tends to relate to prenatal care, referral systems, and high risk care.

Newborn Care

Phase I analyses indicated that there was not much variability in the “newborn care” category among the different groups of mothers, therefore Phase II analyses of this category were not conducted.

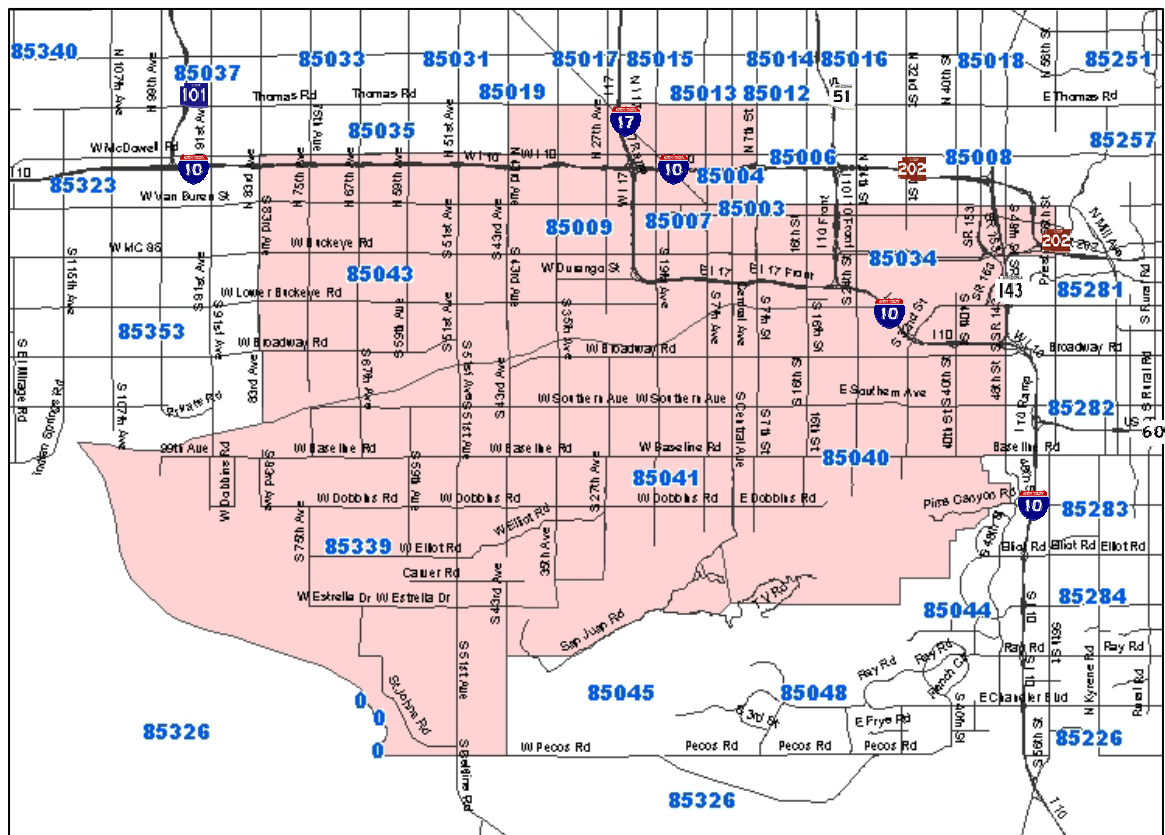
Infant Health

Phase I analyses indicated that there was some excess fetal and infant death in the “infant health” category but not enough excess to further examine, therefore Phase II analyses of the “infant health” category were not conducted.

Section V. PPOR: South Phoenix Neighborhood

Phase I: Feto-Infant Mortality

The South Phoenix neighborhood was defined by 10 zip codes: 85003, 85004, 85007, 85009, 85034, 85040, 85041, 85042, 85043, and 85339 (see map below). Fetal and infant deaths and live births for the period 1996 through 2000 are included in these analyses. There were a total of 245 fetal and infant (feto-infant) deaths and 23,225 live births and fetal deaths in the South Phoenix area. The corresponding total feto-infant mortality rate (F-IMR) was 10.6 deaths per 1,000 live births and fetal deaths. This means that for every 1,000 recognized pregnancies that survived 6 months or more, 10.6 resulted in either a miscarriage or the death of a baby. The South Phoenix rate during the period was higher than the county's rate (8.5 deaths per 1,000 live births and fetal deaths).



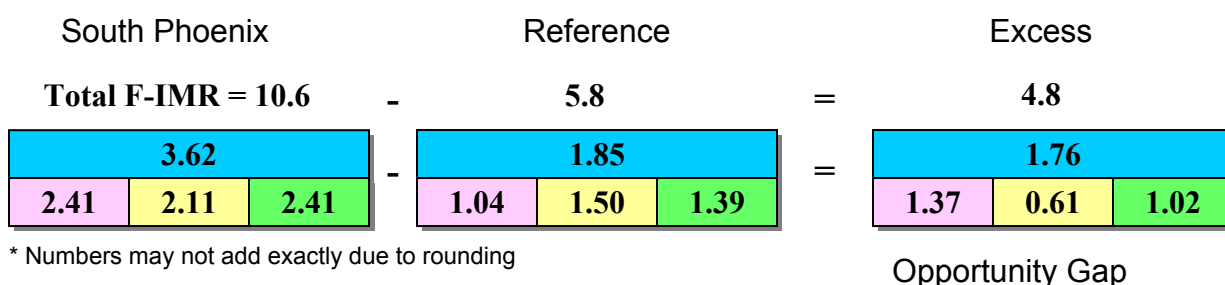
 South Phoenix

South Phoenix, Phoenix, Arizona

Excess (Preventable) Feto-Infant Mortality

Figure 14 shows PPOR findings of South Phoenix (left), reference group (middle), and the excess feto-infant mortality (right) in the South Phoenix area, as well as the method to obtain the excess. Subtracting the reference group's F-IMR (5.8) from South Phoenix's F-IMR (10.6) yielded an excess F-IMR of 4.8 (feto-infant deaths per 1,000 live births and fetal deaths). The amount of excess mortality suggests the extent to which the F-IMR can be theoretically reduced in South Phoenix. The excess F-IMR can be described as an "opportunity gap" and shows disparities within the population. The highest group-specific F-IMR was in the "maternal health/prematurity" category (3.6 deaths per 1,000 live births and fetal deaths). "Infant health" and "maternal care" categories followed with rates of 2.4 deaths per 1,000 live births and fetal deaths, while the "newborn care" category showed the lowest rate (2.1 deaths per 1,000 live births and fetal deaths). This is a conservative estimate of the actual excess; the reference group was not removed from the South Phoenix numbers.

Figure 14. South Phoenix Opportunity Gap (Excess Feto-Infant Mortality Relative to the Reference Group) Potential for Reduction



Each of the group-specific rates was subtracted from the corresponding group rate. The largest excess rate was in the "maternal health/prematurity" category with 1.76 deaths per 1,000 live births and fetal deaths. "Maternal care" showed an excess rate of 1.37, "infant health" an excess rate of 1.02, and "newborn care" an excess rate of 0.61 (deaths per 1,000 live births and fetal deaths).

If the South Phoenix F-IMR was similar to the reference group's F-IMR, there would have been 111 fewer feto-infant deaths during the five-year period than actually occurred. These excess deaths represented 45% of the feto-infant mortality in South Phoenix.

See Figure 15 for the translation of rates into number of deaths over the period. Of the 111 excess feto-infant deaths, 41 occurred in the "maternal health/prematurity" category, 32 were in the "maternal care" category, 14 were in the "newborn care" category, and 24 were in the "infant health" category.

These findings suggest that successful prevention and intervention efforts focused on "maternal health/prematurity" and "maternal care" should yield larger reductions in the overall excess feto-infant mortality rate in South Phoenix more than focusing on other points in the health care continuum.

**Figure 15. South Phoenix Potential for Reduction:
Excess Rates Translated Back to Numbers**

Total Number of Excess Deaths = 111

		<i>Fetal</i>	<i>Neonatal</i>	<i>Post Neonatal</i>
<i>Birth Weight</i>	500-1499 g.	Maternal Health/Prematurity 41		
	1500+ g.	Maternal Care 32	Newborn Care 14	Infant Health 24

Excess Feto-Infant Mortality for Selected Population Groups

The excess rates were also examined by population groups to determine which group contributed more to the excess feto-infant mortality. Risk factors within each population group can affect infant mortality. This knowledge allows prevention efforts to be further focused on those groups with higher mortality rates.

Excess Feto-Infant Mortality by Age Group

Maternal age was categorized into two groups: women under 20 years old (teenagers) and women 20 or more years of age. For teenagers, there were a total of 52 feto-infant deaths and 5,273 live births and fetal deaths. For women 20 or more years of age, there were a total of 193 feto-infant deaths and 17,949 live births and fetal deaths. The excess F-IMR for teenagers was lower than the excess rate for women 20 or more years of age in South Phoenix (4.1 and 5.0 deaths per 1,000 live births and fetal deaths, respectively). The direction of this difference is opposite of the findings in the county.

Although the “maternal health/prematurity” category showed the highest excess rate for both groups (1.94 and 1.71 for younger and older women, respectively), the second highest rate differed. The second highest rate was in the “infant health” category for women who were under 20 years of age but was in the “maternal care” category for women who were 20 years of age or older.

Excess Feto-Infant Mortality by Education Group

The level of maternal education was categorized into two groups: women with a high school education or less (≤ 12 years) and women with any education beyond high school (> 12 years). There were a total of 165 feto-infant deaths and 13,524 live births and fetal deaths for women with a high school education or less. For women with some education beyond high school, there were a total of 59 feto-infant deaths and 8,761 live births and fetal deaths. Figure 16 shows the

excess feto-infant mortality for both education levels. There was a large difference between the total excess F-IMRs in the two education groups.

The excess death rate for women with less education was 6.4 while the rate for women with more education was 0.96 deaths per 1,000 live births and fetal deaths.

For those with a high school education or less, the highest group-specific excess rates were in the “maternal care” and “maternal health/prematurity” categories. Education is an antecedent factor for other measures such as income levels, access to care, and behavioral patterns and a proxy measure for socioeconomic status (SES). Therefore, increasing the population’s education level would not necessarily decrease all the risk factors for feto-infant mortality but it may help to improve outcomes dependent on incomes, behaviors, and access to care.

**Figure 16. South Phoenix Excess Feto-Infant Mortality Rate
(Number of Deaths) by Education Group (1996-2000)**

< =12 years (6.4 rate, N=165)			> 12 years (0.96 rate, N=59)		
Maternal Health/Prematurity 2.29 (31)			Maternal Health/Prematurity 0.32 (3)		
Maternal Care 2.36 (32)	Newborn Care 0.50 (7)	Infant Health 1.28 (17)	Maternal Care -0.47* (-4)	Newborn Care 0.44 (4)	Infant Health 0.67 (6)

* Too few deaths for a stable rate

Excess Feto-Infant Mortality by Race/Ethnicity Groups

During the five year period, there were a total of 179 feto-infant deaths and 17,690 live births and fetal deaths for Hispanics; 28 feto-infant deaths and 2,639 live births and fetal deaths for Whites; 26 feto-infant deaths and 1,905 live births and fetal deaths for African Americans; and 10 feto-infant deaths and 769 live births and fetal deaths for Native Americans. African Americans (7.9 per 1,000 live births and fetal deaths) and Native Americans (7.2 per 1,000 live births and fetal deaths) had the highest total excess F-IMRs.

The number of feto-infant deaths was too small statistically for the African American and Native American groups to further subdivide the total rate. See the Maricopa County results in Section III to target interventions for African and Native Americans. The total excess F-IMR for Hispanics in South Phoenix was 4.3 deaths per 1,000 live births and fetal deaths. For Hispanics, the highest group-specific excess F-IMR was in the “maternal health/prematurity” category, and the second highest excess rate was in the “maternal care” category.

Summary of Phase II Results

In Phase II, the analyses focus on potential risk factors for those areas with excess mortality. In order to conduct the Phase II analyses, there need to be large enough numbers of births and deaths in the group, such as teenagers, with excess mortality (at least 60) and the preventable death rate needs to be large enough within a category (at least 1.5) in order for the statistical methods used to be reliable.

Table 7 shows the South Phoenix area summary of groups with excess fetal and infant deaths by category from the Phase I analyses. The groups and categories that met the criteria (at least 60 deaths in the group and an excess mortality rate in the category of 1.5 or higher) for further analyses are shown with a check mark (✓).

Table 7. Summary of Population Groups with Excess Mortality by Category from the Phase I Results that are Examined in Phase II (Groups with Check Marks).

South Phoenix Group	Maternal Health & Prematurity	Maternal Care	Newborn Care	Infant Health
<i>All mothers</i>	✓			
< 20 years old	✓			✓
≥ 20 years old	✓	✓		
≤ 12 years Education	✓	✓		
>12 years Education				
White				
Hispanic	✓	✓		
African American				
Native American				

Because over 75% of the births in South Phoenix are to Hispanic women, the number of fetal and infant deaths to women in other race/ethnicity categories was too small to examine in Phase II. Although their numbers were not large enough to further examine here, high excess feto-infant mortality was found for African American, Native American, and White mothers. Different methodologies would be necessary to examine these groups in the South Phoenix area in more detail (e.g., focus groups, fetal and infant mortality review, or child fatality review). To target these groups of women for prevention efforts based on these analyses, see the results for all of Maricopa County. As discussed in the Overview section, only summaries of the Phase II analyses are presented here. Please see the complete document for analyses and methods.

Maternal Health and Prematurity

The first step in describing the reasons for excess “maternal health/prematurity” death rate is determining whether this excess is due to more VLBW babies or more babies dying at each birth weight. The South Phoenix area as a whole and four South Phoenix population groups had high enough excess fetal and infant death rates attributed to the “maternal health/prematurity” category to further examine:

- South Phoenix area overall
- Women under the age of twenty
- Women 20 years of age or more
- Women with a high school education or less
- Hispanic women.

At least half of the “maternal health and prematurity” related mortality was associated with too many VLBW babies in each of the groups examined. In addition, at least 40% of the mortality was associated with high mortality at VLBW in each of the groups. Therefore, risk factors for both pathways were examined.

Table 8 shows those risk factors deemed important (defined in the Overview) by each pathway to excess mortality in the “maternal health/prematurity” category. The risk factors, important for VLBW in South Phoenix babies, consisted of small for gestational age, prematurity, unmarried, less than 15 pounds pregnancy weight gain, and few or no prenatal care visits. Smoking does increase the chances of having a VLBW baby. Smoking cigarettes was not checked in the table because these groups of women did not smoke more than the reference group. In South Phoenix, however, more than 6% of the women smoked during pregnancy. This suggests that there is room to reduce these smoking rates further.

Table 8. Summary of Important Risk Factors for Deaths in the “Maternal Health/Prematurity” Category.

Birth Weight Distribution (Maternal Health)					
Risk Factors	S. Phx Area	Teenagers	=> 20 Years Old	< 12 Years Education	Hispanic
IUGR/SGA	✓	✓	✓	✓	✓
Prematurity	✓	✓	✓	✓	✓
Unmarried (social support/SES)	✓	✓	✓	✓	✓
Smoking					
Weight Gain < 15 lbs.	✓	✓	✓	✓	✓
Few Prenatal Care Visits	✓	✓	✓	✓	✓
Birth Weight-Specific Mortality (Perinatal Conditions/Care)					
Few Prenatal Care Visits	✓		✓	✓	✓
Fever During Labor/Delivery	✓				✓

Note. Check marks indicate the risk factor is important for deaths in the “maternal health/prematurity” category.

Risk factors for more babies dying at very low birth weights consisted of few or no prenatal care visits and a fever during labor/delivery for the South Phoenix area as a whole and South Phoenix Hispanic women. Few or no prenatal care visits was also a risk factor for women who were 20 or more years of age and women who had a high school education or less.

The largest contributor to excess rates in South Phoenix was the “maternal health and prematurity” category, suggesting that women’s health prior to conception play a prominent role in determining fetal and infant outcomes.

Maternal Care

Deaths associated with “maternal care” are higher birth weight (1500 grams or more) fetal deaths. Potential risk factors that may increase the risk of fetal death include maternal infection, maternal injury, delays in obtaining medical care for prenatal care or delivery, delays in

recognizing potential problems such as decreased fetal activity, inadequate referral systems, and inadequate monitoring. The risk factors examined were presented in the Overview.

An important, modifiable risk factor was inadequate prenatal care. Women who received adequate levels of prenatal care (as defined by ACOG) were less likely to have a higher birth weight fetal death. Diabetes was an important risk factor for higher birth weight fetal deaths for each of the groups with high excess deaths in the “maternal care” category. The exception was women with a high school education or less who did not have higher levels of diabetes than the reference group. Although all diabetes cannot necessarily be prevented at this point, there are health behaviors that increase the risk of diabetes.

Table 9. Summary of Important Risk Factors for Deaths in the “Maternal Care” Category

Risk Factors	South Phoenix Area	Hispanics	20+ Years of Age	<= 12 Years Education
Inadequate Prenatal Care	✓	✓	✓	✓
Maternal Diabetes	✓	✓	✓	
Prematurity	✓	✓	✓	✓
Small for Gestational Age	✓	✓	✓	✓

Although placenta previa/abruptio, breech, and cord prolapse were significant risk factors for the deaths attributed to the “maternal care” category, the South Phoenix groups with a high excess death rate in the “maternal care” category did not have higher levels of the risk factor than women in the reference group.

Newborn Care

Phase I analyses indicated that there was not much variability in the “newborn care” category among the different groups of mothers, therefore Phase II analyses of the “newborn care” category were not conducted.

Infant Health

Deaths attributed to “infant health” are those deaths that occur to larger babies (> 1500 grams) from 28 days and one year of life. The first analysis for excess death rate in the “infant health” category was an examination of the underlying cause of death. The categories are perinatal conditions, congenital conditions, infections, sudden infant death syndrome (SIDS), injuries, ill-defined, and other. See Table 10 for a brief explanation of each category.

Table 10. Underlying Cause of Death (COD) Categories Used for Classification of the Deaths Due to “Infant Health” Risk Factors and Causes.	
COD Category	Description
Perinatal Conditions	Deaths due to perinatal conditions include those due to maternal factors and complications of pregnancy, disorders of gestation and fetal growth, birth trauma, specific respiratory, cardiovascular and infectious conditions specific to perinatal period, hemorrhagic and hematological disorders of the newborn, and endocrine and metabolic disorders
Congenital Conditions	Birth defects are physical or mental disabilities that may be fatal. A few examples are Spina Bifida, Downs Syndrome, and Cleft Palate but thousands of birth defects are currently known.
Infections	Include respiratory, gastrointestinal, central nervous system, septicemia, and others.
SIDS	The unexpected, sudden death of an infant under one year of age that continues to be unexplained after a complete investigation
Injuries	Consist of homicide, motor vehicle accidents, poisoning, falls, fire, drowning, suffocation, and other unintentional injuries.
Ill-defined	Ill-defined deaths include other symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified.
Other	All other causes of death that do not fit into the classification scheme are included in the other category.

South Phoenix teenagers had high rates of infant mortality attributed to the “infant health” category. The most prevalent underlying causes of death were infections and SIDS. These are the same leading causes of death for all births in the county as well. Respiratory infections were the most common group of infections. Only two risk factors other than maternal demographic characteristics were examined because many of the risk factors for these deaths tend to be environmental and not reported during vital registration. Few or no prenatal care visits was an important risk factor for both causes of death. Although smoking during pregnancy increased the risk of SIDS, South Phoenix teenage mothers did not smoke more than the reference group. Other research indicates that smoking during pregnancy increases the risk for both SIDS and reduced lung function in the baby. Second-hand smoke exposure also increases the risk for both SIDS and asthma later in life.

Section VI. Community Mobilization

Under the direction of the Family Health Partnerships program at Maricopa County Department of Public Health (MCDPH), there have been over 600 targeted contacts made in Maryvale and South Phoenix to develop support and awareness in their respective communities for PPOR and maternal and child health issues. This has included coalition/consortium meetings, one-on-one contacts, community presentations, outreach activities, and interactions with elected officials. In May 2004, Phase II PPOR data was presented to both of the targeted communities.

It's A Baby's Life project in Maryvale, South Phoenix Healthy Start (SPHS) and MCDPH sponsored community presentations of Phase II PPOR data on May 3 (Maryvale) and 19 (South Phoenix), 2004. Elected officials, Phoenix Councilmen Mattox and Lingner, State Representatives Linda Lopez and Leah Landrum, agreed to be part of these important events. About 60 community members, coalition/consortium members, and other stakeholders attended each presentation and ensuing work sessions. Representatives from various provider offices, government entities, social service agencies, foundations, school districts, higher education institutions, hospitals, and community residents attended the events. Participants worked in small groups to target the broad key areas found to contribute to local fetal/infant mortality disparities:

- ▲ Socio-economic environment
- ▲ Health of women prior to and between pregnancies (interconceptional)
- ▲ Health of mother during pregnancy
- ▲ Access to health care
- ▲ Infant health (South Phoenix only)

Potential interventions that could be effective within the specific community were identified and prioritized based on most value and impact. Recommended interventions from each group were presented to the full group at each presentation. At both presentations, attendees were asked to complete commitment cards if they were ready to assist the project in lowering fetal/infant mortality and improve birth outcomes. Forty-nine cards were completed with many of them from community residents.

Maryvale

Over the past two years, MCDPH, the Healthy Mothers Healthy Babies Coalition, South Phoenix Healthy Start, and various organizations and community members have joined together to mobilize Maryvale in an effort to empower the community to take on the responsibility of improving birth outcomes. As a result of funding received from St. Luke's Health Initiatives and The Virginia G. Piper Charitable Trust, MCDPH was able to create a part-time position (Community Mobilization Manager) and recruit four Maryvale residents, who were already active in community change efforts, to volunteer. These volunteers are referred to as community mobilizers and have received training in MCH issues, PPOR, and community mobilization. Consequently, many businesses, faith-based organizations, apartment complexes, child care centers, and schools have received information about PPOR, information on healthy lifestyles and its impact on birth outcomes, and on how to access health care services.

Mobilizers developed:

- one-on-one relationships with businesses, apartment complexes, schools, social service and faith-based organizations, etc.
- partnerships with community leaders
- public education mechanisms through bulletin boards, presentations, brochures
- relationships with places where they felt most comfortable
- leadership skills to manage the project with minimal support.

To show appreciation, mobilizers received small stipends.

The *It's A Baby's Life* coalition and steering committee have reviewed the intervention strategies suggested at the Maryvale Summit. They have decided to concentrate on community interventions that will improve women's health before, during, and between pregnancies. However, the steering committee also decided that they would identify potential agencies in the community that might consider working on some of the other additional strategies generated at the Summit.

As a result of PPOR analyses, it is recommended that potential interventions in Maryvale include:

- Increasing tobacco cessation programs and efforts
- Increasing access of uninsured non-pregnant women to receive annual exams
- Increasing the availability of teen sex awareness education
- Utilizing media to raise awareness
- Increasing services in the local neighborhoods that target MCH issues
- Forming liaisons between providers and the community
- Connecting individual women to numerous services utilizing non-traditional approaches
- Engaging elected officials to encourage policy development and support
- Developing female support groups.
- Developing support for a Maternal, Fetal, and Infant Mortality Review Board

The Family Health Partnerships Program at MCDPH is available to provide grant writing and other types of technical assistance so that these interventions will be developed and implemented by community based organizations that serve the Maryvale community.

South Phoenix

Healthy Start is a federally funded infant mortality reduction effort. South Phoenix Healthy Start (SPHS) accepts all high risk families prenatally or postnatally, however SPHS particularly targets African American and Native American families for perinatal health needs and socio-economic challenges. Families are provided intensive case management and health education. Another federally required component is to impact the health care system to improve access and utilization of health care. This is primarily done through a large community consortium. SPHS consortium members have proposed the following priority interventions as a result of PPOR data analyses:

Healthy Start Early Pregnancy Health Outreach Project to establish a school-based pregnancy health outreach project.

“Healthy You, making Healthy Decisions, making Healthy Babies” project to increase self-worth contributing to a woman’s ability to make healthy lifestyle and family planning decisions

Baby Arizona – A Rebirth Announcement to educate, inform, and recruit potential health plan members and providers regarding benefits and utilization issues.

Early Intervention Healthy Start Project for Males to promote positive fatherhood practices, provide leadership and advocacy, and educational activities in Healthy Start families.

“Baby your Baby” project to promote and support practices and resources contributing to healthy infants throughout the community.

In summary, the major community accomplishments in the last year include:

- Over 600 targeted stakeholder contacts
- Several elected officials have become actively committed to using PPOR data to make a difference in their communities
- Six representatives from the community are now leading the *It’s A Baby’s Life* Coalition.
- Four community residents have become well trained, empowered advocates for MCH issues in their respective communities referred to as mobilizers
- Community-based strategic planning conducted to develop project goals for the South Phoenix Healthy Start program
- Neighborhood organizations have adopted *It’s A Baby’s Life* as a community sponsored project.
- The *It’s A Baby’s Life* logo (portrait of a local child) is recognizable throughout the Maryvale community.
- Due to mobilizers’ community education and awareness, there has been an increase in demand for prenatal care, therefore more low-cost prenatal care has been made available by Maryvale Hospital and Mountain Park Health Center.

Future Efforts

A post-partum bedside survey will be implemented in the Fall of 2004 by the Alliance for Innovations in Health Care. Newly delivered mothers from Maryvale and South Phoenix will be interviewed to gather more data on barriers to care, customer service concerns, and disparity issues. The survey was developed by the Friendly Access program of The Lawton and Rhea Chiles Center for Healthy Mothers and Babies, University of South Florida. The two research questions to be answered by the Friendly Access program when implemented include: 1) Does improving customer service to pregnant women increase access to and utilization of health services, both preventive and curative? 2) Does increasing access and utilization improve certain health indicators? Survey results will be made available in the summer of 2005.
